Utilizing Pro-bono Commercial Assets for Marine Mammal Surveys in High Naval Activity Area in Hawaiian Waters

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LONG-TERM GOALS

The waters surrounding the State of Hawaii are high U.S. Navy activity regions with the presence of Pearl Harbor on the island of Oahu, the FORACS (Fleet Operational Readiness and Accuracy Check Site) acoustic range operated by the Hawaii Detachment of NUWC-Newark along the Waianae coast of Oahu, and PMRF (Pacific Missile Range) in the waters off the island of Kauai and the shallow waters of west Maui. Furthermore, the RIMPAC exercises (Rim of Pacific Exercises) that occur on a regular basis involve considerable Naval resources operating close to and within Hawaiian waters. The Pacific Navy is under considerable pressure from environmental groups that have initiated up to five law suits to curtail the Navy's use of active sonar for training. Perhaps the best approach in combating the various environmental concerns expressed in the different lawsuits is to gather scientific data and obtained important information on the abundance and distributions of marine mammals in the high Navy activity area of Hawaii. The ocean is large and the chances of avoiding any interaction with any sizable group of marine mammals are probably much greater than the probability of encountering marine mammals. However, the cost of negative encounters is disproportionately high in terms of negative publicity and law suits so it would be prudent to take steps to increase the odds against any encounters. So we return to the fact that basic information on the biology, natural history, and behavior of dolphins and whales that frequent waters of high Navy activities are needed in order to avoid encounters.

Marine mammal surveys around the Hawaiian Islands have been sparse and localized. In 2002, the National Marine Fisheries Services conducted a visual and acoustic survey within the Hawaiian archipelago (Barlow et al., 2004; Rankin and Barlow, 2007). Another NMFS cruise took place in February of 2009, almost 7 years since the previous one. The 2002 and 2007 surveys also took place within a specific time period and the information, while useful, is limited in temporal and spatial pattern for a specific time period in terms of season, month and year. Aerial surveys have been conducted in conjunction with the North Pacific Acoustic Laboratory Program from 2001 to 2004 (Mobely, 2002, 2003, 2004a,b). However, these aerial surveys occurred mainly around the island of Kauai, and only during the humpback whale winter season in Hawaii. The results pertained, only a specific season and in a relative localized area. Furthermore, aerial surveys are limited to daylight hours and relatively calm seas. Robin Baird from Cascadia Research have conducted brief marine mammal surveys for several years, usually once a year (see Baird et al., 1008a, b, c,d,e). His surveys tend to be short 2 weeks and a month in shallow waters and in selected waters. Certainly, more

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information is need over all four seasons and in a broader geographic region that is not restricted only to daylight hours.

The goal of this project is to perform regular, but relatively inexpensive acoustic surveys in the deep waters between Oahu and Hawaii and Oahu and Kauai on a seasonal basis using the assets of the Young Brothers Company, the largest inter-island shipper in Hawaii. Young Brothers have offered to participate with us by allowing us to board their tugs and use our acoustic instruments to collect data, on a pro-bono basis. We hope to establish a robust database of information that currently does not exist in the deep waters between islands.

OBJECTIVES

The objective of this study is to map the distribution and abundance of whales and dolphins in the deep waters between the island of Oahu and Hawaii and the island of Oahu and Kauai.

APPROACH

The basic approach is to use the assets of Young Brothers, the largest inter-island shipper in Hawaii. Tug boats towing large barges make regular runs from the economic and business center of the State of Hawaii, the city of Honolulu. Mr. Mark Houghton, Vice President of Maritime Operation of Young Brothers, has agreed to allow acoustic monitoring equipment to be located on some of their barges without charging the University of Hawaii. Such a project would allow Young Brothers to perform an interesting public service. A map of three routes between Honolulu and W. Hawaii, between Honolulu and E. Hawaii and between Honolulu and Kauai is shown in Figure 1.

The original concept was to use a 2-hydrophone array attached to the barge, which is usually about 600 m behind the tug boat to collect acoustic data which would be telemetered to the tug boat via a wireless link. However, after much discussion with the barge foreman it was decided that this concept was not workable. Now we are attaching a tow body that is attached to the barge with a hydrophone attached to the tow line. A picture of the tow body is shown in Figure 2 and other pieces of equipment are shown in Figure 3.

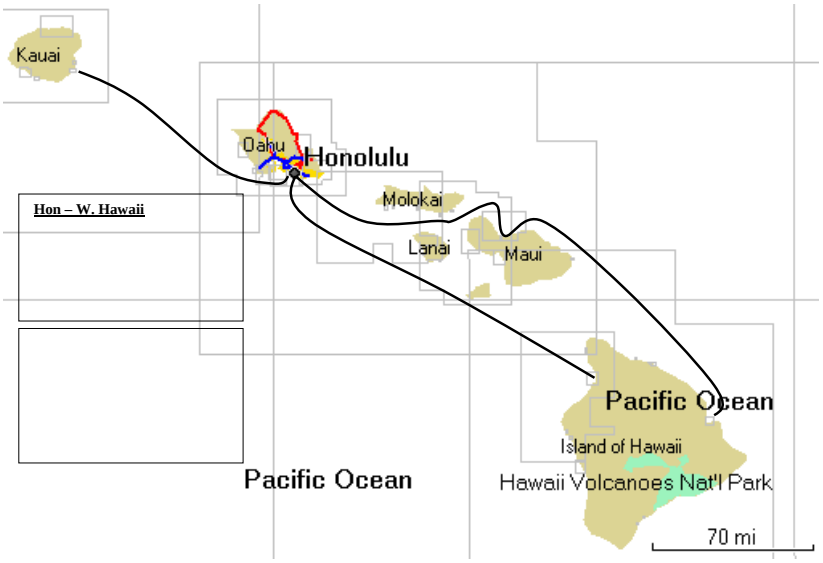

Figure 1. Map of the main Hawaiian Islands and three different Young Brothers barge route along with typical schedules between Honolulu and West Hawaii and Kauai.

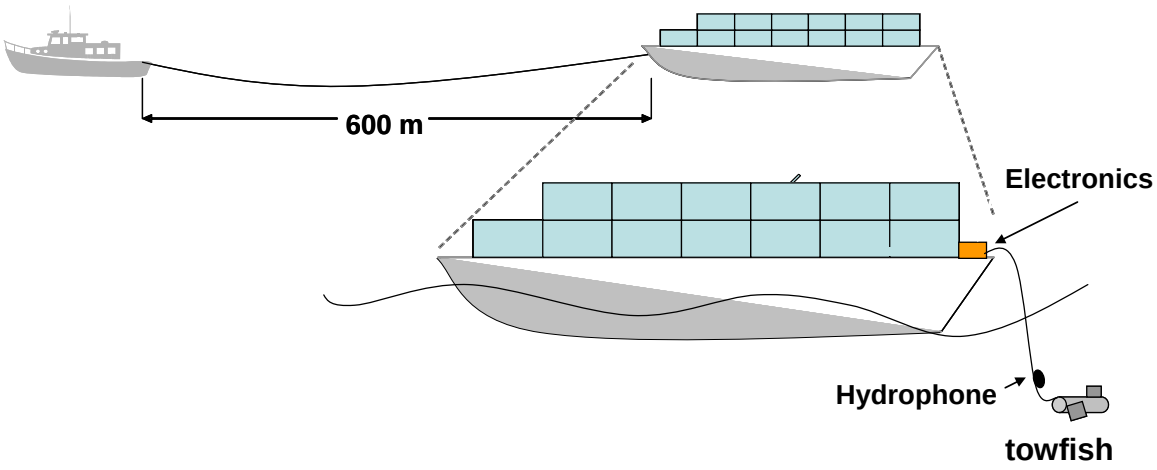

Figure 2. Experimental geometry showing towfish behind barge. The hydrophone is attached to the tow line.

Figure 3. Equipment used to monitor for marine mammals.

WORK COMPLETED

Funds were made available to this project in July, 2008, however, most of the work on this project did not commence until September because of prior commitments. We have re-engineered our existing Ecological Acoustic Recorder (EAR) technology for use in this application by constructing a deck unit, adding an underwater tow cable, and designing, building and adding a pre-amplifier to the hydrophone recorder in order to drive the sound up the length of the cable and reduce noise (Figure 3). This recording equipment has been tested under controlled circumstances in the captive dolphin pens at the Hawaii Institute of marine Biology, and was successful at capturing dolphin sounds in this situation. After controlled testing, we tested the towfish equipment on the Young Brothers Barge. The equipment was easily secured to the deck of the barge (Figure 4) and we successfully collected data for two round-trips from Honolulu of Oahu to Kawaihi Harbor on the Big Island. These trips covered a total distance of 664 miles. Beaufort sea state during these trips ranged between 1 and 5, most time spent at a 5 or above. The sea state highlights the importance of doing acoustic surveys in these areas of low visibility conditions. During these two initial trips, we recorded a total of 53.5 hours of acoustics recordings were made. When these recordings were visually inspected for cetacean calls, 8 distinct groups of cetaceans were found, for a total of 64 calls (Figure 5). During some sightings, echolocation signals were also recorded (Figure 6). We are currently building an additional modified towfish to reduce noise and increase the signal to noise ratio of the whistles recorded, as well as analyzing all whistles using ROCCA, a custom computer program which predicts species using whistle parameters. Future work includes using GIS for comparisons of cetacean detection to depth and remotely sensed oceanographic data.

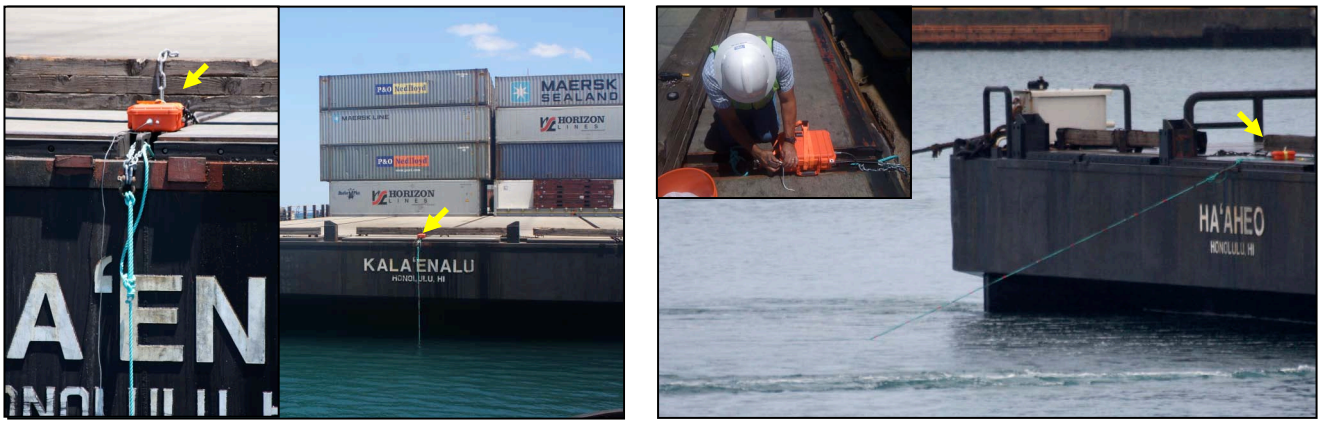

Figure 4. Acoustic recording equipment deployed on the Young Brothers barges Kala'enalu and Ha'aheo in port (A,B). Acoustic recording eqipment being secured on deck and underway at a speed of 5 knots. Yellow arrows point to the onboard electronics.

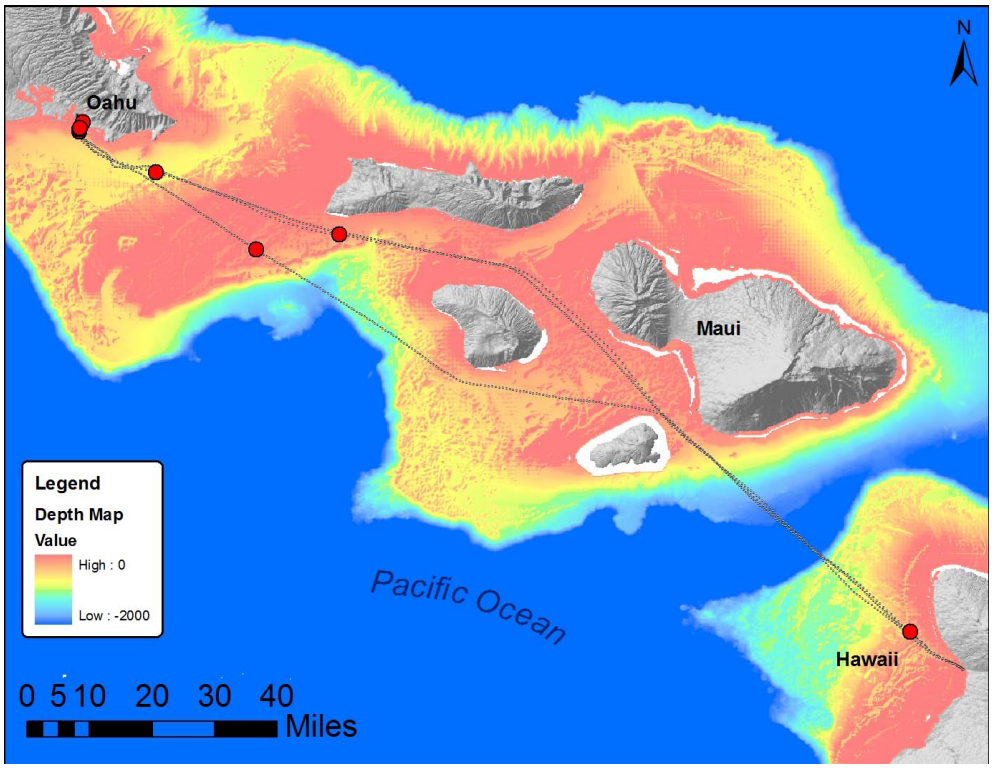

Figure 5. Map showing barge tracks, as well as detections and depths for two trips. The black dotted line indicates the ship track, while the red dots indicate locations of detections. Note that there are more detections than there appear to be on this map, because some detections near Oahu overlap.

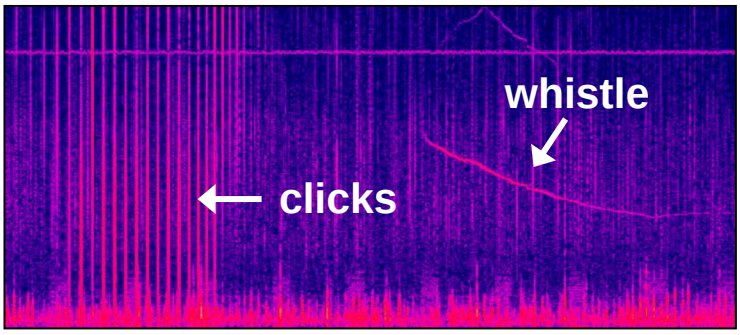

Figure 6. Acoustic recordings of dolphin clicks and a whistle from the deployment on July 30, 2010. The animal making these sounds was visually identified as a bottlenosed dolphin (Turcips truncatus).

IMPACT/APPLICATIONS

None

RELATED PROJECTS

None